SLOVENSKI STANDARD
oSIST prEN 14620-2:2026

01-oktober-2026

Načrtovanje in proizvodnja na mestu postavitve grajenih navpičnih, valjastih jeklenih posod z ravnim dnom za shranjevanje hlajenih utekočinjenih plinov z delovnimi temperaturami med 0 °C in –196 °C - 2. del: Kovinski deli

Design and manufacture of site built, vertical, cylindrical, flat-bottomed tank systems for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and -196 °C - Part 2: Metallic components

Auslegung und Herstellung standortgefertigter, stehender, zylindrischer Flachboden-Tanksysteme für die Lagerung von tiefkalt verflüssigten Gasen bei Betriebstemperaturen zwischen 0 °C und -196 °C - Teil 2: Metallische Bauteile

Conception et fabrication de réservoirs cylindriques fond plat, verticaux, construits sur site, destinés au stockage des gaz réfrigérés, liquéfiés, dont les températures de service sont comprises entre 0 °C et -196 °C - Partie 2 : Constituants métalliques

Ta slovenski standard je istoveten z: **prEN 14620-2**

ICS:

23.020.10	Nepremične posode in rezervoarji	Stationary containers and tanks

oSIST prEN 14620-2:2026 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 14620-2

September 2026

ICS 23.020.10

Will supersede EN 14620-2:2006

English Version

Design and manufacture of site built, vertical, cylindrical, flat-bottomed tank systems for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and -196 °C - Part 2: Metallic components

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 265.

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Ref. No. prEN 14620-2:2026 E

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European foreword

This document (prEN 14620-2:2026) has been prepared by Technical Committee CEN/TC 265 “Metallic tanks for the storage of liquids”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document is intended for use in conjunction with relevant parts of EN 1993 and so adheres the general rules for the structural design of any tank component within the scope of Eurocode 3.

prEN 14620-2:2026 includes the following significant technical changes with respect to EN 14620-2:2006:

— general editorial update;

— terms and definitions adjusted;

— normative references updated;

— material requirements extended to temperatures down to −196 °C;

— steel classification updated to be independent on containment type;

— toughness requirements updated;

— design based on limit state theory and reference to Eurocodes added where appropriate;

— nozzle details completely revised;

— change of section title “inspection” to “weld examination”;

— testing for membrane tanks updated;

— acceptance criteria for weld examination updated;

— informative annexes about actions on membrane and determination of the load and fatigue curves for membrane deleted and incorporated into main part;

— new informative annex with recommendations for drop-weight testing of heat-affected zone (HAZ) and weld metal added;

— new informative annex for wide-plate crack arrest testing added;

— new informative annex with typical combinations of actions added;

— bibliography updated.

A list of all parts in the EN 14620 series, “Design and manufacture of site built, vertical, cylindrical, flat-bottomed tank systems for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and −196 °C”, can be found on the CEN website.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

1 Scope

This document specifies general requirements for the materials, design, construction and installation of the metallic components of refrigerated liquefied gas tank systems.

This document deals with the design and manufacture of site built, vertical, cylindrical, flat-bottomed tank systems for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and −196 °C.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM E208, *Standard Test Methods for Conducting Drop-Weight Test of Ferritic Steels*

EN 1593, *Non-destructive testing — Leak testing — Bubble emission technique*

EN 1759-1, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, Class designated — Part 1: Steel flanges, NPS 1/2 to 24*

EN 1990, *Eurocode — Basis of structural and geotechnical design*

EN 1991-1-4, *Eurocode 1 — Actions on structures — Part 1-4: Wind actions*

EN 1991-1-6, *Eurocode 1 — Actions on structures — Part 1-6: Actions during execution*

EN 1993-1-1, *Eurocode 3 — Design of steel structures — Part 1-1: General rules and rules for buildings*

EN 1993-1-6, *Eurocode 3 — Design of steel structures — Part 1-6: Strength and stability of shell structures*

EN 1993-1-8, *Eurocode 3 — Design of steel structures — Part 1-8: Joints*

EN 1993-1-9, *Eurocode 3 — Design of steel structures — Part 1-9: Fatigue*

EN 1993-1-10, *Eurocode 3 — Design of steel structures — Part 1-10: Material toughness and through-thickness properties*

EN 1998-4, *Eurocode 8 — Design of structures for earthquake resistance — Part 4: Silos, tanks, pipelines, towers, masts and chimneys*

EN 1999-1-1, *Eurocode 9 — Design of aluminium structures — Part 1-1: General rules*

EN 10025, *Hot rolled products of structural steels*

EN 10028-1, *Flat products made of steels for pressure purposes — Parts 1: General requirements*

EN 10028-2, *Flat products made of steels for pressure purposes — Parts 2: Non-alloy and alloy steels with specified elevated temperature properties*

EN 10028-3, *Flat products made of steels for pressure purposes — Parts 3: Weldable fine grain steels, normalized*

EN 10028-4, *Flat products made of steels for pressure purposes — Parts 4: Nickel alloy steels with specified low temperature properties*

EN 10028-5, *Flat products made of steels for pressure purposes — Parts 5: Weldable fine grain steels, thermomechanically rolled*

EN 10028-6, *Flat products made of steels for pressure purposes — Parts 6: Weldable fine grain steels, quenched and tempered*

EN 10028-7, *Flat products made of steels for pressure purposes — Parts 7: Stainless steels*

EN 10029, *Hot-rolled steel plates 3 mm thick or above — Tolerances on dimensions and shape*

EN 1011-2, *Welding — Recommendations for welding of metallic materials — Part 2: Arc welding of ferritic steels*

EN 10160, *Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflection method)*

EN 10204, *Metallic products — Types of inspection documents*

EN 10216-1, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties*

EN 10216-2, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10216-3, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes*

EN 10216-4, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 4: Non-alloy and alloy steel tubes with specified low temperature properties*

EN 10216-5, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 5: Stainless steel tubes*

EN 10217-1, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Electric welded and submerged arc welded non-alloy steel tubes with specified room temperature properties*

EN 10217-2, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10217-3, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 3: Electric welded and submerged arc welded alloy fine grain steel tubes with specified room, elevated and low temperature properties*

EN 10217-4, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 4: Electric welded non-alloy steel tubes with specified low temperature properties*

EN 10217-5, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 5: Submerged arc welded non-alloy and alloy steel tubes with specified elevated temperature properties*

EN 10217-6, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 6: Submerged arc welded non-alloy steel tubes with specified low temperature properties*

EN 10217-7, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 7: Stainless steel tubes*

EN 1090-3:2019, *Execution of steel structures and aluminium structures — Part 3: Technical requirements for aluminium structures*

EN 1092-1, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 13445-2, *Unfired pressure vessels — Part 2: Materials*

EN 13445-3, *Unfired pressure vessels — Part 3: Design*

EN 14620-1:2024, *Design and manufacture of site built, vertical, cylindrical, flat-bottomed tank systems for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and -196 °C — Part 1: General*

EN 14620-3, *Design and manufacture of site built, vertical, cylindrical, flat-bottomed steel tanks for the storage of refrigerated, liquefied gases with operating temperatures between 0 °C and -165 °C — Part 3: Concrete components*

EN ISO 14732, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials (ISO 14732)*

EN ISO 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1)*

EN ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules (ISO 15607)*

EN ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding (ISO 15609-1)*

EN ISO 15614-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1)*

EN ISO 17635, *Non-destructive testing of welds — General rules for metallic materials (ISO 17635)*

EN ISO 17636-1, *Non-destructive testing of welds — Radiographic testing — X- and gamma-ray techniques with film (ISO 17636-1)*

EN ISO 17637, *Non-destructive testing of welds — Visual testing of fusion-welded joints (ISO 17637)*

EN ISO 17638, *Non-destructive testing of welds — Magnetic particle testing (ISO 17638)*

EN ISO 17640, *Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment (ISO 17640)*

EN ISO 20485, *Non-destructive testing — Leak testing — Tracer gas method (ISO 20485)*

EN ISO 3452 (all parts), *Non-destructive testing — Pentrant testing (ISO 3452)*

EN ISO 9016, *Destructive tests on welds in metallic materials — Impact tests — Test specimen location, notch orientation and examination (ISO 9016)*

EN ISO 9606-1, *Qualification testing of welders — Fusion welding — Part 1: Steels (ISO 9606-1)*

EN ISO 9712, *Non-destructive testing — Qualification and certification of NDT personnel (ISO 9712)*

ISO 12135, *Metallic materials — Unified method of test for the determination of quasistatic fracture toughness*

ISO 15653, *Metallic materials — Method of test for the determination of quasistatic fracture toughness of welds*

ISO 23277, *Non-destructive testing of welds — Penetrant testing — Evaluation of indications*

ISO 23278, *Non-destructive testing of welds — Magnetic particle testing — Acceptance levels*

ISO 5817, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14620-1:2024 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
amplitude of strain
one half of the range of strains

3.2
examination
testing in compliance with applicable standards for non-destructive examination

3.3
inspection
activity to ensure compliance with this document

3.4
minimum specified ultimate tensile strength (f_u)
minimum specified ultimate tensile strength of steel or weld material at room temperature whichever is lesser

3.5
minimum specified yield strength (f_y)
minimum specified yield strength of steel or weld material at room temperature whichever is lesser

Note 1 to entry: For steels, other than austenitic steels the yield strength or 0,2 % proof strength shall be applicable. For austenitic stainless steels the 1,0 % proof strength shall be applicable.

3.6
mounting
nozzle or permanent attachment to the pressure containing elements of the tank system

3.7
nominal thickness
ordered thickness of the material

Note 1 to entry: This thickness includes any corrosion allowance and is used for determination of PWHT requirements, weld spacing, minimum and maximum thickness limitations, etc.

3.8
range of strain
difference between the maximum and minimum values in the cyclic strain curves

3.9
shell
self-standing cylindrical wall of a liquid, vapor or purge gas container or a membrane tank outer container

4 Materials

4.1 Temperatures

4.1.1 General

The temperature to which the steel may be exposed under all conditions shall be determined.

4.1.2 Temperatures for materials to contain cryogenic liquid or gas products

4.1.2.1 Primary liquid container

The design metal temperature shall be the minimum design temperature according to EN 14620-1:2024.

In cold regions, where the lowest one-day average ambient temperature (lodmat) according to EN 14620-1:2024 is lower than the minimum design temperature, the design metal temperature shall be lowered by 3 K.

4.1.2.2 Secondary liquid container and thermal protection system (TPS)

The design metal temperature shall be the lower of either the minimum design temperature or the lodmat according to EN 14620-1:2024.

4.1.2.3 Refrigerated temperature roofs and suspended roofs

The design metal temperature shall be in accordance with 4.1.2.1.

4.1.2.4 Warm vapor or purge gas container components designed for accidental contact with cryogenic liquid due to leakage

Design metal temperature for warm vapour container and purge case container components which are designed to be potentially exposed to cold liquid product due to accidental leak in process piping should be from material in accordance with 4.1.2.2 unless those components are protected against cold product exposure by other means.

4.1.2.5 Other components

Design metal temperature for components contained within the primary container shall be in accordance with 4.1.2.1. For components contained within the annular space the design metal temperature shall be as follows:

— for tank systems having a secondary liquid container in accordance with 4.1.2.2;

— for tank systems having a warm vapour container or a purged gas container the lower of the temperatures per 4.1.2.1 and 4.1.3.

4.1.3 Temperatures for warm vapour container or purged gas container and other structures not to contain cryogenic liquid or cryogenic gas products

The reference temperature according to EN 1993-1-10 shall be lowered by at least 3 K by means of application of the safety allowance-due to the cooling effect of the cryogenic product.

This requirement also applies to the concrete tank steel liner not designed to act as a cryogenic liquid barrier.

4.1.4 Maximum design metal temperature

The purchaser shall specify the maximum design metal temperature.

4.2 Primary and secondary liquid container, membrane tank outer container and thermal protection system (TPS)

4.2.1 General

The basis of material selection is that the steel, in addition to initiation resistance, has the capability to arrest brittle fractures. The base material is therefore capable of arresting short cracks that may extend across a horizontal weld seam or associated with a vertical weld seam and propagate into the base material.

All mechanical testing shall be conducted on the test coupons after simulation of at least two full heat treatment cycles for plates subject to PWHT.

4.2.2 Steel classification

Plate materials shall be classified as follows:

— Type 1 steel: low temperature carbon-manganese steel;

— Type 2 steel: nickel alloyed steel;

— Type 3 steel: austenitic stainless steel.

For each product, the steel types shall be in accordance with Table 1.

Table 1 — Product and steel class

Product	Typical design metal temperature	Steel class [a]
Butane, butadiene	−15 °C	Type 1
Propane, propylene	−50 °C	Type 2 [b]
Ethane, ethylene	−105 °C	Type 2 [c]
Methane	−165 °C	Type 2 [c]
NOTE Table note.		
[a] Higher-order steel type may be used, e.g. type 3 instead of type 2. [b] Lower-order steel type 1 may be used if the rules of 4.2.6 are followed.		

[c]	Welds shall be produced with austenitic high nickel filler with Ni content not less than 45 %.

4.2.3 General requirements

4.2.3.1 Type 1 steel

A Type 1 steel is a fine-grained, low carbon steel. The steel shall meet the following requirements:

— the steel shall be specified to meet the requirements of EN 10028-3, EN 10028-5 or EN 10028-6. Steels with a minimum yield strength greater than 420 N/mm² shall not be used. Minimum yield strength limit can be increased to 460 N/mm² if alternative rules for material selection in 4.2.6 are applied;

— the carbon content shall be less than 0,20 %. The carbon equivalent CEV shall be equal to or less than 0,43 with

$$CEV = C + \frac{Mn}{6} + \frac{\left(Cr + Mo + V\right)}{5} + \frac{\left(Ni + Cu\right)}{15}$$

— all mechanical testing, including toughness testing per 4.2.5 or 4.2.6, for type 1 material which is expected to undergo post-weld heat treatment (PWHT) per 8.4, shall be performed on test coupons after simulation of at least three PWHT cycles.

4.2.3.2 Type 2 steel

A Type 2 steel is a nickel alloyed steel. The steel shall meet the following requirements:

— the steel shall be specified to meet the requirements of EN 10028-4;

— the steel with more than 1 % Nickel shall be quenched and tempered.

4.2.3.3 Type 3 steel

Type 3 steel is an austenitic stainless steel according to EN 10028-7.

4.2.4 Maximum plate thickness

The maximum shell plate thickness shall be:

— Type 1 steel: 40 mm;

— Type 2 steel: 50 mm;

— Type 3 steel: no upper limit on thickness.

When material thickness is required in excess of these values, additional material investigation and testing shall be carried out to demonstrate that the same level of resistance to brittle fracture is available as would be required for the type of material and maximum thickness indicated above.

The maximum thickness for shell and roof components in compression shall be 75 mm.